8PRTS

09/242219

300 Rec'd PCT/PTO 09 FEB 1999

M.f.6 H 04 N 7/00
H 04 N 7/08
A 61 B 6/00
A 61 B 6/02

HIGH RESOLUTION TV SYSTEM

The invention concern to the structurial shemes of the high resolution TV systems using at least of the two TV cameras and the "sewing" of the integrate image from parts means. Such systems may be mainly used for the X-ray functional diagnosis needs, for example:

for angiographic examinations using of the radiopaque substances, in particular for the vessel passage evalution and the blood-supply efficiency of the organs and tissues estimation,

for fluoroscopic control of the surgical operation motions using the probes, catheters and other instruments, entering into the organism through the gullet, anus and blood-vessels,

for fluoroscopy of the lungs, heart, stomach and other floating organs,

for filmness radiography in the traumatology,

for filmness fluorography by the mass examinations of the population and

for radiography in the urology and other fields where it's necessary the periodical observation of the slow spriading of the radiopaque substance in the organism.

The examinations of the indicated types as far as medicine development become more mass and - in totality - expensive procedures. Therefore, the refusal from still recently usual photos and cine filming using film (and, especially, X-ray sensitive) materials a quite long time became the serious problem.

It's natural, in the modern level of the TV and computer technique development passage on the "filmness" X-ray diagnosis is possible first of all by way of creating (X-ray) TV systems.

However, on this way exist some of the principal difficulties.

First of them is conditioned by flowing of the many physiologic processes (especially, circulation) with such speed by it entered the radiopaque substances in a blood channel are leaving

the observation zone in time approximately from the second part to some seconds. Therefore, objectively exist the necessity in the quite high speed TV filming (with image change frequency none less 25 film/sec).

Further, the diagnosis cost of the X-ray TV images in essential degree depend from their resolution faculty. In other words, their legibility (from 3 to 5 line couple on 1 mm) and contrast mustn't be worse then in the film image. Accordingly, it must be allowed the integrate image decomposition none less then on the 3000 x 4000 elements.

And finally, X-ray TV systems must be as more as simple and, accordingly, technological in the manufacturing, accessible by price, releable and comfortable in the exploitation.

The separate execution of the indicated requirements by way of the TV system design using specialized TV cameras don't be essential difficulties.

Realy, already it's known TV camera building on the MOS-structures (metal-oxyd-semiconductor) and having in the output cascades also MOS-transistors (futher TV camera) of the model KAF-16800 (Kodak) with format 4096 x 4096 elements (News Briefs, Tech Briefs... Medical Imaging, The Busines Magazine For Technology Management, Vol. 10, No 12, 1995, p.20).

This TV camera - by having data - is unusual by the resolution facility.

However because of the necessity of aberation corections it has quite complicated construction (especially in the optical part) and because its manufacturing and exploitation is expensive. Besides, MOS-structures provide the image change frequency none more 0,5 film/sec., it's permissible, for example, for filmness radiography in the traumatology, but essentially below of the required minimum 25 film/sec. for angiography and even for control of the surgical operation motions (about 7 film/sec.).

Therefore they aren't stoped the attempts to raise the resolution facility and image change frequency in the (X-ray) TV systems using essentially more cheap and hihg reliable traditional TV cameras.

So, Philips XQ5002 model TV system is built with help the tube wiht 2000 line scan with resolution by line none more 1350 elements (Murphy G., Bitler W., Lybrook J., Slevener T., Broemelsiek M. The

application of a Pllumbicon TV-camera tube in 2000-line system // Proc.SPIE. 1994. Vol.2163.P.333-339).

From limited by 20 MHz of the videosignal frequency bar this system has image change frequency none more 7,5 film/sec. Such image change frequency is sufficient, for example, for fluoroscopic control of the surgical operation motions, but obviously it's unsufficient for angiographic examinations. Usual, for experts in the given technique field, calculations is showed that the widening of the videosignal frequency bar to 30 MHz might be obtained the resolution to 2000 elements in line, but with same image change frequency 7,5 film/sec. However, this widening is difficulted of the specialized preliminary videointensifier creating necessity using the input widebar cascades and the own noise level decrising necessity of the TV transmission tube.

Increasing of the resolution facility to 2000 x 2000 element in one film level is obtained in the (X-ray) TV system for gastrointenstinal examinations using SATICON TV cameras, they are optically connected to the X-ray source though the optical distributor and X-ray electron-optical convertor (Ogura N., Masuda Y., Fujita H. Technical and clinical evalutions of a 2048x2048 matrix digital radiography system for gastrointestinal examinations // Ibid. 1991. Vol. 1443. P.401-408). It's allowed to obtain the image change frequency only 0,94 film/sec.

For avoiding the widening of the videosignal frequency bar by way of the above indicated technical difficulty overcoming such TV system worth while use only for the slow elapsing physiologic processes observation and quickly elapsing processes may be filmed on the wide (to 100 mm) cine film for lasting analysis.

The indicated means are comforted (although and expensive) for diagnostic examinations in the situations when the patient life don't threatened immediate danger, but practically don't be used for fluoroscopic control of the surgical operation motions and unsuitable by mass population fluorographic examinations.

The application attempts in the (X-ray) TV systems with image change frequency none less 25 film/sec of the TV high resolution cameras on the big format matrixs of the semiconductorя charge coupled devices (futher CCD), described Ninkov Z. et al (Characterization of a Large Formate CCD Array//Optical Engeneering, 1995. Vol.**34**. No 1), are bounded with some more high requirements to

the videosignal frequency bar width.

So, for comercially accessible TV cameras on the CCD matrixs the videosignal frequency bar don't exceed 30 MHz. However, even for 2000 x 2000 element image decomposition with image change frequency 25 film/sec. the videosignal frequency bar must be about 100 MHz. By passage on the 3000x4000 element format, that is near to the X-ray film resolution by 30x40 cm size, the videosignal frequency bar must be already abouy 300 MHz, it many times exceeds the possibilities of the existing TV cameras on the CCD matrixs.

Natural exit from the indicated difficulties may be provided by way of the multicameras TV system creating in them each quickly acting TV camera with the standart videosignal frequency bar is aimed at the examination or observation object part and totality given images may be used for introducing of such object in whole.

The simpliest utilization example of this principle may serves the guarding and observation TV systems, for example, VC-Profi (V701-003), CSS-4223, Videoman (JHV-501) in them at least the two TV cameras are connected to common monitor and/or the summary image analysator (see the Catalogue "Equipment for videoobservation and videocontrol systems" Ultra Star, South Korea, published by the Guardian technologies Centre in Moscow, 1995, p.36).

Such systems are quite efficient for floating or low-contrast objects in common observation field.

However, forming of them summaring image consist from the simple corresponding by the fields of vision of the separate TV cameras the separate parts with obvilously visible margins between such parts and resolution facility of such systems in essence equal to monitor resolution facility on its is otput the summary image.

Therefore these systems without essential improvements mustn't be used in the integrate object observation system composition (requiring detailed reflection) and, in particular, in the X-ray diagnisis complex composition for angiography needs (and even for control of the surgical operation motions).

None the less, such type systems may serve by the base for the high resolution (X-ray) TV system creating.

It's thought, by technical essence from number of such systems to supposing one most like the high resolution TV system (in origin- "Multy-source Image Real Time Mixing and Anty-Aliasing") by patent USA 5.351.067 (Lumelsky L. et al).

This system has:

at least the two input channel-sources of the requiring image parts, in particular, at least the two TV cameras in succession are connected in each indicated channel:

- analog-digital convertors (futher - ADC),
- random-access memory (futher - RAM) and
- output videosignal standart convertors;

output videosignal synthesis means connected with TV camera outputs and are:

- at least the two mixers, they are connected to outputs of the indicated standart convertors;
- at least the two multiplexers in them:

-- the control inputs are connected to common control block, containing PC, the buffer memory block and the videosignal distribution block,

-- on the first information inputs are connected the indicated mixers and on the second information inputs - the indicated standart convertors, and

-- they, begining with second, in succession are connected through the third information inputs to the preceding multiplexors and

-- on the last multiplexor output are connected the high resolution monitor (display);

central processing unit on the PC base of.

In the described TV system with help the multiplexors are obtained the essential (to 260 MHz) widening of the common output videosignal frequency bar and thereby it's decided visialisation task simultaneously on the one screen some images, thir location may be chosen by operator's wish in the different combinations and scales and they may change one after other wiht frequency 25 and more film/sec.

However, even with location of the input TV cameras like, that the totality of their fields of vision would exceed all area of any integrate observation or investigation object, on the system output isn't a success to form integrate image without the fields of vision visible margins of the separate TV cameras. This don't desirable efect arises:

in first, therefore, in each input cascade is inevitable (they are insignificant each in separate) geometric distortions, they will

the visible show in the output (synthesited) videosignal, the nearer to the observation or investigation object are located the TV camera objectives;

in second, therefore, especially the obtaining initial data hardware (TV cameras, ADC and other) mustn't be absolutely identify in their exploitation characters.

In result, the discribed system can't be efficiently used in the integrate objects observation system composition (requiring detail reflection) and, in particular, in the high resolution X-ray TV diagnosis system composition for floating image analysis, in them the distance between the TV camera objectives and investigation (for example, vascular system) or observation (for example, surgical probe moving by tubing organ) object must be as possible as less. The necessity in the minimisation of the indicated distence is caused:

in first, the radioactive influence decreasing on the human organism necessity (and this influence may decrease maximumly using the light flux on the primary X-ray convertor output in the visible light);

in second, obtaining necessity as possible as more detailed images of the investigation or observation objects.

In connection with said in the invention base is laid the task by way of the composition and structure improvement create the high resolution TV system, it would provide the efficient "sewing" of the separate images in the dynamic process integrate picture (excluding the "joints"), is characterized by the resolution none less 3000 x 4000 elements with legibility and contrast none worse then in the wide format X-ray photo- or cine film.

The putting task is decided like that in the high resolution TV system having at least the two TV cameras, the analog-digital convertors (ADC) block, the videosignal standart convector, the random-access memory (RAM), the output videosignal synthesis means connected with TV camera outputs and with each other and central processing unit on the PC base, according to the invention, the output videosignal synthesis means are executed on the multichannel geometric distortion corrector and synchronisator base, by this, the indicated corrector is connected through the ADC block to the TV camera outputs and through the videosignal standart convector and RAM - on the PC input and synchronisator is connected

through its control input - on the synchronisation output at least the one of the TV cameras and through their control outputs - on the clock input of the ADC block, on the address inputs of the indicated corrector and on the address and control synchronisating inputs of the videosignal standart convector.

The execution of the output videosignal synthesis means on the multichannel geometric distortion corrector and synchronisator base and theirs connection in the system srtucture as it's above indicated, provides the necessary and sufficient premises for essential decreasing of the geometric distortions influence are arised in the TV system input cascades, on the output (synthesed) videosignal quality. Really, for efficient "sewing" separate image parts of the investigated or observeted object in integrete image in most cases it sufficiently take into consideration and remove the partial exceedes of the separate TV cameras fields of vision and geometric distortions carried in their output videosignals by optical systems.

The first additional difference consist in that, the TV system is provided by primary (X-ray) source and X-ray image convertor in the visible image, they are in succession mounted before TV cameras. This addition is, in most cases, sufficient for using of the suggesting TV system in the X-ray diagnosis complexe composition.

The second additional difference consist in that, the TV system is provided at least a one calibrated test-object in the form of spacing mire, it by system installation may be located before TV cameras. It make easiest the installation of the suggesting TV system on the separate image "sewing" of the investigated and observated object parts in integrate image of this object.

The third additional difference consist in that, the TV system is provided by calibrated test-object location in the field of vision means and removal these objects from TV camera fields of vision, it's connected on the control synchronising output of the synchronisator and this synchronisator is additionally correlated with PC operated reverse connection circuit. It's reached the automatic installation of the TV system by necessity of the operative correction of the "sewing" integrate image quality from the images of the separate TV cameras.

The forth additional difference consist in that, the TV system is provided by the high resolution monitor, it's connected on

information output of the videosignal standart convertor and RAM. It is provided the possibility of the immediate operator perception of the "sewing" integrate image of the invesigated or observated object (by frequency none less 25 film/sec.).

The fifth additional difference consist in that, the indicated geometric distortion multichannel corrector in each TV system channel has:

on the input:

- at least the two indentical corrected coordinate calculators accordingly by horizontal and vertical of each of image elements in the output videosignal calculating on the base of the initial coordinates of the analogous image elements in the input videosignal and the corrected coefficients, and

- at least the two indentical controlled memory blockof the input digital videosignal are connected to the indicated calculators as address sources for the information reading about corrected elements of the output videosignal, and

on the output:

- the inventor, it's connected between the above indicated synchronisator and one of the indicated controlled memory blocks, and

- the output multiplexor for alternative connection outputs of the indicated controlled memory blocks on the above indicated videosignal standart convector and ADC input.

Such geometric distortion multichannel corrector structure is preferable for the X-ray TV systems installated on the integrate image "sewing" from images forming by separate TV cameras using the hard spacing mires.

The sixth additional difference consist in that, in the indicated multichannel corrector:

each indicated calculator has, at least the:

- one input comparator with fixed value of the threhold digital code is connected to the one of the ADC output,

- one decipherator is connected on the address outputs of the input image pixel coordinates with the above indicated synchronisator and having the two control outputs,

- two logical I shemes, each of them are connected to the indicated comparator output and to the synchronisator control output and one of them is connected to the first one and second one-

to the second control output of the indicated decipherator,

- two nonvolatile ADCs in them:

-- control inputs are independely connected to the corresponding logical I shemes outputs and

-- address and information inputs also are independely connected accordingly to the address outputs of the above indicated synchronisator,

- one decipherator connected on the address output one of the coordinates of each input image pixel with the above indicated synchronisator (by this, in first and second nonvolatile ADCs of the first calculator on their information inputs enter the signal corresponding to the one of coordinate of each input image pixel, on the address inputs same ADCs enter the signal corresponding to the second coordinate of each input image pixel and on the corresponding inputs of the first and second nonvolatile ADCs and on the dechipherator of the second calculator the indicated signals enter in reverse order),

- one difference cascade with the two information inputs separately connected accordingly to the information outputs of the indicated nonvolatile ADCs,

- the standartisator for integer-valued division of the digital parallel signal code setting one of the coordinates of each distorted image pixel, on the digital constant code, setting one of the non-distorted raster geometric sizes (accordingly by horisontal in one and by vertical in other calculator),

- multiplier for multiplication of the digital codes one of the standartizated coordinates of each input image pixel on the corresponding to this coordinate flowing size digital code of the distorted raster,

- summator for adding of the beginning reflection image distorted field coordinates digital codes and the following augment of the treating image pixel coordinates in same raster,

and each controlled memory block has:

- two input multiplexors, each of them is intended for forming of the corresponding input and corrected image pixel coordinate digital codes and connected to the indicated multiplexors

- ADC for writing by one input videosignal addresses and reading by other output corrected image videosignal addresses.

The described channel structure of the geometric distortions

corrector most efficiently promotes to the "sewing" of the integrate image from fragmental images forming by separate TV cameras with practically full exception of the information losses on the joints.

The seventh additional difference consist in that, in the indicated videosignal standart convertor is united with indicated ADC and has:

unbound by the information inputs the RAM banks, the their number equal the TV cameras number and in each of them are included the:

- two address multiplexors and
- two frame RAMs;

RAM bank operation dechipherator;

first digital analog convertor;

buffer RAM, containing the:

- parallelly connected memory blocks, their number equal TV camera number and
- buffer RAM dechipherator and

second digital analog convertor.

The unification of the videosignal standart convertor with RAM promotes to the reduction of costs on the hardware of the indicated functions usely to the TV and, in particular, X-ray TV systems orientated on the "sewing" integrate image from images forming separate TV cameras.

The eighth additional difference consist in that, in the united videosignal standart convertor with RAM:

(a) in each mentioned RAM bank:

the information inputs of the frame RAM are united and connected to the corresponding outputs of the indicated geometric distortions multichannel corrector and their information outputs also are united (including - and between banks) and are connected to the information input of the first digital analog convertor;

the first multiplexor inputs are united and connected to the synchronisating outputs of the writing corrected image coordinate codes in the frame RAMs in the above indicated synchronisator and the multiplexor second inputs are also united and connected to the synchronisated outputs of the reading corrected image coordinate codes from frame RAM in the above indicated synchronisator;

the first outputs of the first multiplexor are connected to

the corresponding inputs of the fisrt frame RAM address and the first outputs of the second multiplexor are connected to the corresponding address inputs of the second frame RAM;

the second control input of the first multiplexor and the second (inverse) control input of the second multiplexor are connected to the control output of the above indicated synchronisator;

the multiplexor first outputs are connected to the address inputs, their second outputs - to the control inputs of the chip selection and their third outputs - to the control inputs of the reading-writing coresponding RAMs;

(b) in all RAM banks:

the first control inputs of the first and second multiplexes are united and connected accordingly to the first, second and other decipherator outputs, and

the information outputs of all frame RAM are united and connected to the information input of the first digital analog convertor;

(c) the decipherator control input is connected to the conrtol output of the above indicated synchronisator;

(d) the first and second control inputs of the first digital analog convertor acordingly are connected to the synchronisating outputs of the above indicated synchronisator and the information output of this convertor are connected to above indicated high resolution monitor;

(e) the address inputs of the buffer RAM memory blocks are united and connected to the synchronisating outputs of the above indicated synchronisator with coordinate codes; their information inputs are connected to the corresponding outputs of the above indicated geometric distortions multichannel corrector; their information outputs are united and connected to the information input of the second digital analog convertor; their reading-writing operation inputs are connected to the control output of the above indicated synchronisator and the information input of the last memory block of the indicated buffer RAM is connected to the corresponding information input of the frame RAM;

(f) the decipherator control inputs of the buffer RAM are connected to corresponding information outputs of the above indicated synchronisator and the information outputs of the

indicated decipherator are connected to inputs of the memory blocks chip selection so, that the first of the indicated outputs is tied with the indicated input of the first memory block, the second - with the input of the second memory block and other;

(g) the information input of the second digital analog convertor are connected to the united information outputs of the memory blocks, the information inputs of this convertor are accodingly connected to the synchronisating outputs of the above indicated synchronisator and their information output are connected to the above indicated videosignal inter in PC block.

The described concrete structure of the united videosignal standart convertor with RAM is preferable for forming of the integrate high resolution big format image from many (10 and more) composite parts each of them are, in particular, characterized by essentially smaller resolution.

The ninth additional difference consist in that, the synchronisator has:

the first seting synchronisating signal generator corresponding to the TV camera resolution, the clock output is connected to the clock inputs of the above indicated ADC blocks and the multichannel threshold control device and

at least the one second seting synchronisating signal generator corresponding to the synchronisating image high resolution standart;

two meter groups accodingly for X and Y coordinates of the image pixels forming by each TV camera, and

two meter groups accodingly for Xm and Ym coordinates of the high resolution synchronisated image pixels;

at least the one synchroimpulse selector intended for picking out the initial synchronisated impulses from the full TV signal and forming of the output horisontal and vertical synchronisating impulse;

two digital comparators accordingly for Xm and Ym coordinate codes;

two one-vibrators for forming of the horisontal (line) and vertical (frame) impulses corresponding to the high resolution standart;

at least one high resolution synchronisating image pixel number meter;

the I sheme for conjuntion by forming of the control signals

for the above indicated geometric distirtion corrector;

the input registor for reception indicated control commands by synchronisator entering from the indicated PC;

output registor for the information giving about conditiom of the indicated synchronisator in the indicated PC and

address decipherator by programmely forming port of the indicated PC for giving in the indicated control command synchronisator,

by this:

the first setting generator is connected to the accounted input of the first coordinate X meter group;

the accounted input of the second Y coordinate meter group is connected to the horisontal synchronisating impulse synchroimpulse selector output;

the first Xm coordinate meter group are connected by the accounting input to the second setting synchronisating signal generator;

the accounted input of the second Ym coordinate meter group is connected to the Xm coordinate meter group output through in succession connected one of the digital comparators and one of the one-vibrators;

the reset inputs of the first X coordinate meter group and the first coordinate Xm meter group are connected to the horisontal synchronisating impulse synchroimpulse selector output;

the reset input of the second Y coordinate meter group is connected to such synchroimpulse selector output, with it must be taken off the vertical synchronisating impulses corresponding to the output TV camera image full frame;

the reset input of the second Ym coordinate meter group is connected to such synchroimpulse selector output, with it must be taken off the vertical synchronisating impulses corresponding to the output TV camera image half frame;

the output of the first Xm coordinate meter group is connected:

- to the inputs of all multiplexors and on the RAM banks operation decipherator input of the above indicated videosignal standart convertor with RAM and
- through in succession connected the first digital comparator and the first one-vibrator - to the digital analog convertor same convertor with RAM and also

- to the accounting input of the second Ym coordinate meter group;

the output of the second Ym coordinate meter group is connected:

- to the inputs of all multiplexors of the above indicated videosignal standart convertor with RAM and

- through in succession connected the second digital comparator and the second one-vibrator - to the digital analog convertor of same convertor with RAM and also

- to the accounting input of the number high resolution synchronisating image pixel meter;

the input register is connected:

- by the parallel data input - to the PC,

- by the fisrt output - to the reset input of the number high resolution synchronisating image pixel meter and the control input of the videosignal standart convertor with RAM,

- by the second output - to the second input of the I sheme;

- by the third output - to the D-trigger reset input;

the output register is connected:

- by the fisrt output - to the output of the vertical synchronisated impulses of the above indicated synchroimpulse selector,

- by the second output - to the output of the number high resolution synchronisated image pixels meter, and

- by the output - to the PC;

the address decipherator by programelly forming PC port for giving in the above indicated control command synchronisator is connected:

- by the input - to the PC address bus, and

- by output - to the input registor input;

the number high resolution synchronisating image pixels meter in addition is connected on the control input of the buffer RAM decipherator of the above indicated videosignal standart convertor with RAM.

In spite of looked the functional blocks abundance the discribed form of the synchronisator execution is the most simple invented conception embodiment for needs of the suggested high resolution (X-ray) TV system.

The tenth additional difference consist in that, the synchronisator is in addition supplied of the second I sheme and

D-trigger, moreover:

the indicated I sheme by one input are connected to setting synchronisating signal generator output corresponding to the TV resolution standart, by the second input - to the D-trigger inverse output and the output may be used in the additional circuit of the input signal forming for the above indicated geometric distortion corrector, and

the indicated D-trigger is connected:

- by the information input - to the control output of the above indicated multichannel threshold control device,

- by the synchronisated input - to the synchroimpulse selector output corresponding to the whole frame of the input image,

- by the reset input - to the third output of the above indicated input registor.

The indicated additions promote to the increasing work quality of the geometric distortion corrector and, accordingly, the output image quality.

The eleventh additional difference consist in that, the TV system is in addition supplied by the videosignal amplitude digital corrector, it is connected on the geometric distortion multichannel corrector input by digital videosignal interframe accumulations, the their number usually equal the TV camera number and they are connected between ADC and the indicated videosignal amplitude digital corrector and the multichannel threshold control device, it is connected on the videosignal amplitude digital corrector outputs through the above indicated synchronisator is connected to digital videosignal interframe accumulations control inputs and is supplied the reverse connection control output with primary (X-ray) source.

Such more complicated high resolution TV system most is prefered for X-rays diagnosis needs.

The twelfth additional difference consist in that, the digital corrector of the videosignal amplitudes is executed by multichannel and in each channel has:

the two nonvolatile RAMs, they accordingly are intended for saving of the corrected coefficient codes of the "black" level and the maximum videosignal range for each pixel of the input image from corresponding (to the given channel) TV camera;

the difference cascade for calculation of the input signal and

"black" level code difference for each pixel of the input image from corresponding TV camera;

the divisor for calculation of the standarted coefficients of the input videosignal amplitude correction of the by devision the constant, setting for choosing TV cameras and ADC code of the maximum videosignal range on the alternating code corresponding to the maximum videosignal range for each following pixel of the input image from corresponding TV camera;

the address decipherator by programmely forming PC port for giving of the control command in given channel of the videosignal amplitude digital corrector, in it the input is connected to PC address bus;

the input register for reception of the control commands, entering to PC, in it:

- the first input is connected to the PC data bus, the second input - to the address decipherator output, and

- the outputs are connected to the control inputs of the nonvolatile RAMs;

the output multiplier for forming of the standarted output videosignal codes by devision of the mentioned standarted coefficients on the mentioned signal difference code,

moreover:

the first RAM is connected:

- by the information input - to the corresponding channel output of the above indicated ADC block,

- by the conrtol input - to the first output of the input register,

the second RAM is connected:

- by the information input - to the output of the indicated difference cascade,

- by the conrtol input - to the second output of the input register, and

by the address inputs the both RAMs are connected to X,Y output of the above indicated synchronisator;

the difference cascade is connected:

- by the first input - to the output of corresponding channel of the above indicated ADC block,

- by the second input - to the first RAM output,

- by the output - on the first input of the indicated

multiplier;

the devison is connected between the second RAM output and second multiplier input.

The described structure of the videosignal amplitude digital corrector is preferable for fluoroscopic high resolution TV systems, they in connection with the limitations of the permissible absorbed doses must stably work by as possible more lower X-ray densities of power. Especially it's important the utilisation such correctors in the X-ray monitoring surgical operation motion systems.

The thirteenth additional difference consist in that, the multichannel threshold control device has:

(a) in each channel:

- the first comparator for comparison of the image pixel codes forming by corresponding to the given channel TV camera with the threshold code,

- the I sheme, it by first input is connected to the comparator output and entended for strobition of the clock signal by the output signal of this comparator,

- the meter, the accounting input of it is connected to the indicated I sheme output and it serves for calculation of the such pixels in image frame number corresponding to connected to the given channel the TV camera, the code of them exceed the setting threshold brightness value,

- the register, the information input of it is connected to the meter output and it serves for saving of the parallel output code of this meter,

- the second comparator, the input of its thought the indicated register is connected to the indicated meter output and it serves for comparison of the output code of this meter with the setting threshold image pixel number having the brightness none less mentioned threshold value, and

- the trigger, in it the information input is connected with the indicated comparator output and it serves for the logical output signal writing of this comparator by synchronisating frame impulse and from the above indicated synchronisator; and

(b) common for all channels:

- the address decipherator by programmely forming PC port for giving in the multichannel threshold control device of the threshold brightness value codes, of the pixel number with

the brightness none less of the threshold value and channel number with "1" logical level on the outputs, in it the input is connected to the PC address bus,

- the input register for reception codes of the indicated threshold values entering from PC, in it the first (information) input is connected to the PC data bus and the second (clock) input - to the address decipherator output, the first output (threshold brightness value code) is connected to the united first inputs of the first comparators of all channels and the second output (pixel number code with brightness none less setting) - to the united second inputs of the second comparators of all channels,

- the multiplexor for multipletion of the output signals of all channels, in it the each information input is connected to the trigger outputs of the corresponding channels and the control input - to the synchronisating output of the above indicated synchronisator with X coordinate code;

I sheme for strobition of the clock signal by output signal of the indicated multiplexor, in it the first input is connected to the multiplexor output and the second input is connected with united second inputs of the indicated I shemes of each channel of the multichannel threshold control device and connected to the clock output of the above indicated synchronisator;

- the meter for these channel number calculation, the signals on the trigger outputs of it has the "1" logical level, and it is connected by the accounting input - to the indicated I sheme output and by the reset input though the invertor - to the synchronisating frame impulse output of the above indicated synchronisator,

- the comparator for comparison of the meter output code with the threshold value of the channel number with the "1" logical level on the outputs, connected by the first and second information inputs accordingly to the meter output and to the third output of the indicated input register and by the output - to the primary X-ray source controller,

- the trigger for writing and saving of the indicated comparator output signal, connected by the information input - to the indicated comparator output, by the clock input though the indicated invertor - to the synchronisating frame impulse output of the above indicated synchronisator and by the control output - to the above indicated interframe accumulators though the above

indicated syncronisator,

by this

(c) in each channel is united and in common connected to the synchronisated frame impulse output of the above indicated synchronisator:

- the reset inputs of the pixel number meter with the brightness none less the setting value,

- the clock inputs of all registers, and

- the clock inputs of all triggers, and

(d) the second inputs of the first comparators of all channels are connected to the corresponding information outputs of the above indicated videosignal amplitude digital corrector.

The suggesting form of the multichannel threshold control device executing allows by using of the suggesting (X-ray) TV system for mass radiographic examinations, in first, the efficiently operate by the primary X-ray source work by the permissible absorbed dose and the requared quality of the sintesated integrate image and, in second, optimisate the interframe accumulator works.

Futher the invention essence is explained by detailed description of the suggesting device with refferences on the enclosed figures where it's represented:

fig.1 - the structurial sheme of the suggested high resolution TV system in the most simlpe form of the invention plan hardware;

fig.2 - the structurial sheme of the suggested high resolution TV system in the impovemented form of the invention plan hardware;

fig.3 - geometric distortion multichannel corrector functional sheme;

fig.4 - the functional sheme of the standart convertor with random-access memory (RAM);

fig.5 - the synchronisator functional sheme;

fig.6 - the one channel of the videosignal amplitude digital corrector with fig.2 functional sheme;

fig.7 - the one channel of the interframe accamulator with fig.2 functional sheme;

fig.8 - the functional sheme of the multichannel threshold control device with fig.2;

fig.9 - the shematical picture of the test-object with vertical location of the spacing mir;

fig.10 - the shematical picture of the test-object with

horisontal location of the spacing mir;

The suggested high resolution TV system in most simple form of the hardware (see fig.1), as minimum has:

at least the two TV cameras 1, they:

- in common are installed so, that their fields of vision insignificantly exceeded (these TV cameras may be located by rows in horisontal and/or vertical and in case of need - in diagonal of the arbitrary rectangular contour) and

- usually electrically correlated by the external synchronisation curcuit of the frame and line scans working from one of the TV cameras output;

the analog-digital convertor block 2 (futher - ADC), their number equal the number of the electrically connected on their inputs TV cameras 1 and each of them has the separately non-marked clock input;

the videosignal geometric distortions multichannel corrector having (separately non-marked as a futher in same cases therefore it's obvious the experts in the electronic field):

- the signal inputs connected on ADC block 2 outputs,

- the control input for giving of the addresses, clock impulses and commands;

- the outputs of the corrected digital videosignals;

the TV image standart convertor 4 united with random-access memory (RAM) on the base, for example, static memory (in particular SRAM 128Kx8 type in the form of commercially accessible TC558128AJ chips, TOSHIBA), it:

- the electrically is connected to the signal outputs of the indicated corrector 3,

- has the control input for giving of the addresses, clock impulses and commands and

- is supplied, at least, the one information output and preferably - the two information outputs for giving of the corrected analog videosignals to the consumers;

the videosignal entering block 5 (again in the digital form) in the PC, it electrically is connected to the one of information outputs of the indicated convertor 4 and has at least the one couple "information input - information output";

the quick acting PC 6, it by the direct and reverse connections through the indicated couple "information input - information

output" is electrically connected to the indicated block 5;

the synchronisator 7, it has:

- the control synchronisating input, electrically connected to the last of TV cameras 1 for reception of the synchrosignals of the frame and line scans,

- the control synchronisating outputs on the clock inputs of each ADC in block 2,

- the input-output for information reverse connection with the indicated PC 6;

- the control and synchronisating outputs on the address inputs of the indicated multichannel corrector 3,

- the control and synchronisating outputs on the indicated TV image standart convertor 4 with RAM and

- the control and synchronisating output on the indicated and marked futher relief of the system installation means.

To second, additional output of the indicated TV image standart convertor 4 with RAM may be connected the high resolution monitor 8 for immediate demonstration of the TV image (in particular, X-ray) to the consumer of the visual information.

The TV cameras 1 may be both usual (for example, on the transforming cathode ray tubes of the VIDICON type) and (it's more preferably) on the CCD matrixs, in particular MTV-1802 type, Mintron Enterprise (USA), or TK 2048 type, Tektonix (USA) with 2048x2048 image elements with hidden channel, tree-phase control and dynamical 80 dB range (such matrix have 55,3 x 55,3 mm sizes and 27x27 mkm pixel sizes).

The TV cameras of the first two of indicated types is prefered for quick acting (X-ray)TV systems with image change frequency none less 25 film/sec. The TV cameras of the third type is preferable for high resolution TV systems for large format initial images treating with "sewings" minimum number of the separate parts in integrate summary image (for example, at archivating aero- or cosmic photofilms in it frame change frequency isn't critical parameter).

As ADC in block structure 2 may be used any suitable comercially access chips, for example, AD876 type, Analog Device firm, USA; it's possible also multichannel ADC utilization with electrically unbound channels in TV camera number 1.

Geometric distortion multichannel corrector 3 is described in

detail below with reference on the fig.3.

The TV image standart convertor 4 with RAM may be executed on the multichannel RAM base, decipherator and multiplexors as it is described in detail below with reference on the fig.4.

The videosignal entering in PC 6 block 5 may be executed in the form of comercially access well known to the experts standart devices, for example, AVER series.

As quick acting PC 6 may be used any suitable computer (preferably on the Pentium processor).

The synchronisator 7, it more is showed in detail on the fig.5 and futher is described in detail, may be realized on the base known to electronic experts suitable the synchrosignal selectors of the frame and line scans and suitable control clock and address impulse generators.

In described view prefered TV system may be used for needs, for example, electronic archiving (in digital form) large format (for example, aerophoto- and X-ray) films.

And, finally, in using of the suggesting TV system in structure more complicated, for example, X-ray diagnosis complexes it must has the elecrtomagnetic radiation convertor 9 from one frequency diapason to other frequency diapason (in particular, X-ray in visible radiation).

This convertor 9 usually has view don't marked separately mainly X-ray sensitive fluorescence screen or X-ray electronic optic convertor (XEOC) or scintillated fiberoptic plate.

By this, all TV camera objectives 1 must be turned to indicated convertor 9 with hand their optic output. Accordingly, in the system must be foreseen the placed on the optic input of the convertor 9 suitable source 12 of the primary (in particular, X-ray) radiation, the choose of it for fluoroscopic or radiographic needs don't present essential difficulties for experts.

For installation relief, in particular, in cases of the TV camera 1 number change and/or interlocation and/or their distance to observation or investigation object and/or to convertor 9 very preferably it's necessary that in TV system structure was included:

calibrated test-objects 10 and

means 11 of their location in the TV field of vision 1 in justication and installation of the TV system and their deleting from TV field of vision 1 before output on the working regime

connected to control synchronisated output of the synchronisator 7, and

in order to the synchronisator 7 was connected by indicated information reverse connection circuit with indicated PC 6;

Calibrated test-objects 10 are spacing mirs, they more in detail is described below.

As means 11 of the location and deleting the test-objects 10 may be used any suitable commercially access manipulator or projection device, for example, the standart mechanism of the cassette with X-ray film giving, having sufficient high (usually less +/-1mm) position accuracy.

More complicated high resolution TV system is preferable for X-ray diagnosis needs may be additionally supplied (see fig.2):

videosignal amplitude digital corrector 13 it is connected on the geometric distortion multichannel corrector 3,

digital videosignal interframe accumulators the number of them usually equal TV camera number 1 and they are connected in the interval between ADC block 2 and indicated videosignal amplitude digital corrector 13, and

multichannel threshold control device 15.

Videosignal geometric distortion multichannel corrector 3, the channel number in it equal the TV camera 1 number is on principle, new block of the suggested TV system in any of their possible embodiments, undependely from that, foresee whether it or other embodiment the utilization of the calibrated test-objects 10 (vertical and/or horisontal spacing mirs) for installation.

This corrector 3 is entended for unification ("sewing") of the different TV camera 1 fields of vision in the united high resolution field by removal the geometric distortions of the fragmented images, they may be caused ussualy by the unvisible in separate perception scale and form differences of such images and the mounting inexactitudesof the separate TV cameras 1.

In simpliest case the individual optical parameters of the TV cameras 1 and geometric parameters of their concrete interlocation must be beforehand taken into consideration in indicated corrector 3 in form of corrected coefficients using futher for videosignal corrections.

Futher is showed complicated variant of the invented plan realization foreseen the utilization of the two (vertical and

horisontal) spacing mirs for automatic TV system installation.

Applied to such cases the corrector 3 in each channel on the input preferably has (see fig.3):

two indentical calculator 16 codes of the corrected coordinates Xc and Yc of the each output image pixel on the base of initial X and Y coordinate codes corresponding input image pixels and correction coefficients, and

two indentical control memory block 17 (possible interframe and preferably - frames) of the input digital videosignal are connected to indicated calculators 16 as sources for reading of the information about output videosignal corrected elements.

Every of calculators 16 has:

input comparator 18 with fixed value threshold digital code Ut, is connected to output one of ADC of the block 2;

decipherator (DC) 19, is connected on the address synchronisator 7 output (X or Y) and having two control outputs;

two logical shemes & (I) 20, each of them is connected to comparator 18 output and to the synchronisator 7 control output Ustr and one of them is connected to first and other - to second decipherator 19 control output;

two blocks 21 of the nonvolatile RAM (NRAM) in them:

- control (reading-writing and marked futher "r/w") inputs independingly are connected to outputs of the corresponding logical shemes & (I) 20,

- address and information inputs also independingly are connected accordingly to synchronisator 7 X and Y outputs so, that in 1-st and 2-nd NRAM 21 of the first calculator 16 on the information inputs enter the X signal and on the address inputs - Y signal and 3-rd and 4-th NRAM 21 of the second calculator 16 the opposite: on the information inputs enter Y signal and on the address inputs - X signal;

the differenced cascade 22 with two information inputs are separately connected accordingly to nonvolatile RAM (NRAM) 21 information outputs, that is necessary for final and initial Le(y) and Lb(y) absciss codes in the first calculator 16 and final and initial He(x) and Hb(x) ordinate codes setting - in the second calculator 16 as the raster margins by test-images of the spacing mirs by the TV system installation;

(preferably) table standartizator 23, it provide integrate

digital division of the digital parallel code one of the input X signal (or Y) on the constant digital code setting the geometric size of the non-distorted raster Lo in horisontal (or Ho in vertical) accordingly for first and second calculators 16;

multiplier 24 for multiplying the digital codes of the normated X (or Y) coordinate on the digital code of the following raster size in horisontal (or vertical) and

summator 25 for addition of the coordinate digital codes of the initial reflection distorted image field and following augment coordinate of the treating image element (pixel) in same raster.

Every control guided memory block 17 has:

two input multiplexors 26, each of them (first MXx - for X coordinate and second MXy - for Y coordinate) is intended for forming corresponding digital codes of the pixel coordinates and corrected image and are connected to them

RAM 27 (possibly the interframes and preferably - frames) for writing in one input videosignal addresses and reading in other input videosignal addresses.

At the same time wiht indicated and in detail described above calculator blocks 16 and guided memory blocks 17 the indicated corrector 3 on each channel output has (see fig.3):

the invertor 28, it is connected between above indicated synchronisator 7 and control multiplexor inputs 26 and RAM 27 one of the guided memory blocks 17;

output multiplexor 29, it is intended for alternate connection the outputs of the guided memory blocks 17 on the videosignal standart convertor with RAM input.

The number of the decipherator outputs 19 (DC1 and DC2), logacal chemes & (I) 20 and nonvolatile RAM 21 (NRAM) are showed on the fig.3, correspond to two spacing mir lines for each calibrated test-object 10. In increasing of the line number in the mirs the number of the indicated decipherator outputs 19 and elements 20 and 21 must be accordingly increased and between RAM outputs 21 and difference cascade inputs 22 must be connected additional multiplexors preferably same type that and multiplexors 26.

The videosignal standart convertor 4 with RAM (see fig.4), has:

independed RAM banks, the number of them equal the TV camera 1 number and in each of them are connected:

- - two multiplexors 30 of the address (MXA) and
- two frame RAM 31;

decipherator 32 (DC) of the RAM banks operating;

first digital analog convertor 33 (DAC HRV);

buffer RAM, it contains:

- parallely connected memory blocks 34 (RAM1...RAMN), the number of them equal the TV camera 1 number and
- buffer RAM decipherator 35 (DC CS) and second digital analog convertor 36 (DAC TV).

For each indicated RAM bank typically that: in the frame RAMs 31 the information inputs (DI) are united and connected to corresponding (Ui11, Ui12,.. Ui1Nx, Ui21, Ui22,.. Ui2Nx,.. UiNyNx) geometric distortion multichannel corrector 3 outputs and their information outputs (DO) also are united (including - and between memory banks) and connected to information input of the first digital analog convertor 33;

in the multiplexors 30 the first inputs are united and connected to synchronisator 7 synchronisated outputs with X,Y coordinate codes for writing of the corrected images in the frame RAM 31 and the second inputs are also united and connected to synchronisator 7 synchronisated outputs with Xm,Ym coordinate codes for reading of the corrected images from frame RAM 31;

first outputs of the first multiplexor 30 are connected to corresponding address inputs of the first frame RAM 31 and first output of the second multiplexor 30 are connected to corresponding address inputs of the second frame RAM 31;

the second control input (C) of the first multiplexor 30 and second inverse control input (C\) of the second multiplexor 30 are connected to synchronisator 7 control output (Urw);

the first outputs of the multiplexors 30 are connected to address inputs (A), their second outputs - to control inputs of the choose (CS) and their third outputs - to control inputs (r/w) corresponding RAM 31.

In all RAM banks the first control inputs of the first and second multiplexors 30 are united and connected accordingly to first, second and other of the decipherator outputs 32.

The decipherator 32 control input is connected to synchronisator 7 control output (Udc).

In all RAM banks the information outputs DO of the frame RAM

31 are united and connected to information input of the first digital analog convertor 33 (DAC HRV).

In the first digital analog convertor 33 (DAC HRV):

the first and second control inputs accordingly are connected to synchronisator 7 synchronisated outputs (HHSI) and (HVSI) and

the information output (Uout) is connected to above indicated high resolution monitor 8.

In each buffer RAM memory block 34 (RAM1...RAMN):

address inputs (A) are united and connected to synchronisator 7 synchronisated outputs with X,Y coordinate codes;

the information inputs (DI) are connected to corresponding geometric distortion multichannel corrector 3 outputs;

the information outputs DO are united and connected to information input of the second digital analog convertor 36 and

control inputs (r/w) are connected to synchronisator 7 control outputs. Besides, the information input (DI) of the last RAMN memory block 34 is connected to corresponding information input (DI) of the frame RAM 31 (RAMNyNx),

Control (Udcc) and (Uw) buffer RAM decipherator 35 (DC CS) inputs are connected to corresponding synchronisator 7 control outputs.

Control outputs of the indicated decipherator 35 are connected to choose inputs (CS) of the memory block 34 so, that first of indicated outputs is bound with indicated input of the first block 34, the second - with second block 34 input and other.

In the second digital analog convertor 36 (DAC TV):

the information input is connected to united information outputs (DO) of the memory block 34,

the control input (HSI) and (VSI) accordingly are connected to synchronisator 7 synchronisated outputs and

the information output Upc is connected to block 5 of the videosignal entering in PC.

The synchonisator 7 has (see fig.5):

the synchroimpulse 37 selector, it is intended for distinguishing from full input TV signal (Uin1) initial and forming output line (that is horisontal - HSI) and interframe (that is vertical - VSI) of the synchronisated impulses and connected:

- by input - to output of the synchronisation one of the TV cameras 1 and

- by synchronisated outputs (HSI) and (VSI) - to accordingly to control inputs of the digital analog convertor 36 of the described above videosignal standart convertor 4 with RAM (showed onthe fig.4);

frame impulse selector 38, the inputs of them are connected accordingly to outputs of the line (HSI) and interframe (VSI) synchronisated impulse selector 37 and Uki output - to synchronisated input in detail described futher multichannel threshold control device 15;

accounted T-trigger 39 (T), the input of it is connected to selector output 38 and output - to multiplexsor 30 control inputs of the videosignal standart convertor 4 with RAM (showed on the fig.4);

setting generator 40 of the synchronisated ("synchro-TV") signals corresponding TV camera resolution 1, the ouput (f1) of it is connected to clock inputs of the above indicated ADC blocks 2 and multichannel threshold control device 15 and it is executed, for example, on suitable commercically access quartz resonator;

non-distinguished and non-marked separately formator X and Y coordinate codes, it is executed on the base:

the meter 41 (CTX) of the pixel numbers in each TV camera 1 the image line in it the accounting input (+1) is connected to synchro-TV generator 40 output and reset input (R) - to synchroimpulse selector 37 output (HSI) and

the meter 42 (CTY) of the image line numbers, forming each TV camera 1, the accounting input (+1) of it is connected to synchroimpulse selector 37 output (HSI);

the setting generator 43 synchronisated signals corresponding the high resolution standart (HRV) of the formed high resolution output image and executed, for example, on the suitable commercially access quartz resonator base;

the meter 44 (CTXm) of the pixel number in the formed image line in it:

- the accounting input (+1) is connected to indicated generator 43 (synchro-HRV) output,

- the reset input (R) is connected to the synchroimpulse selector 37 output (HSI),

- the first output (Xm) is connected to synchronisating input (Xm), and

- the second output (Udc) is connected to control input discribed above videosignal staqndart convertor 4 with RAM;

digital comparator 45 (HHSI):

- connected in information input to second output (Udc) of the pixel number in the forming high resolution image line meter 44 (CTXm) and

- intending for successive comparison of the following pixels coordinate (Xm) codes in the forming high resolution image lines with fixed threshold coordinate code Nx of the end line given image determinated the TV camera 1 number, located horisontal in line;

it's desirable - one-vibrator 46 (HHSI) for forming line videosignal synchroimpulses of the formed high resolution image in it:

- the input may be connected to control output of the indicated pixel numbers in the forming high resolution image line meter 44 (CTXm), and

- output (HHSI) may be connected to control input of the above indicated videosignal standart convertor 4 with RAM;

the meter 47 (CTYm) of the formed image line number in it:

- the accounting input (+1) is connected to indicated one-vibrator 46 (HHSI) output,

- the reset input (R) is connected to the synchroimpulse selector 37 output (VSI), and

- the output (Ym) is connected to synchronisating input (Ym) of the videosignal standart convertor 4 with RAM;

digital comparator 48 (HVSI)

- connected in information input to output (Ym) of the forming high resolution image line meter 48 (CTYm) and

- intending for successive comparison of the coordinate (Ym) codes of the forming high resolution image lines with fixed threshold coordinate code Ny of the end frame given image determinated the TV camera 1 number, located vertical in column;

it's desirable - one-vibrator 49 (HVSI) for forming frame videosignal synchroimpulses of the formed high resolution image, it may be connected:

- by input - on the comparator 48 output, and

- by output (HVSI) - to control input of the above indicated videosignal standart convertor 4 with RAM,

- meter 50 (CTUdcc) of the control by reading from buffer RAM

of the videosignal standart convertor 4 with RAM in entering of the synchronisated image in PC 6, in it the accounting input (+1) is connected to indicated one-vibrator 49 (HVSI) output;

two logical shemes 51 & (I) for executing of the conjunction in forming of the control signals Ustr and Uc, entering accordingly:

- in the geometric distortion multichannel corrector 3 for transference of the nonvolatile 21 (NRAM) in the writing or reading of the test-image margin coordinate code reqimes in the system installation and

- in the interframe accumulators 14 for termination of the accumulation in the system installation. For that the first inputs of the logical shemes are united and connected to setting generator 40 output (f1), the output (Ustr) of the first sheme 51 & (I) is connected to corresponding control input of the above indicated geometric distortion corrector 3 and the output (Uc) of the second sheme 51 & (I) is connected to united control inputs of the interframe accumulators 14;

D-trigger 52, it is intended for synchronisation of the begin formation and setting of control signal Uc action duration, entering in the interframe acumulators 14 and in it:

- the synchronisating input (C) is connected to frame impulse selector 38 output,

- the information input (D) is connected to control output (Usn) in detail discribed futher the multichannel threshold control device 15, and

- inverse output (Q\) is connected to second input of the second sheme 51 & (I);

the input register 53 (RG D) for entering by the synchronisator 7 of the control commands, entering from PC 6, in it:

- the parralel data input (D) is connected to data bus PC 6,

- the first output (Um) is connected to meter 50 (Udcc) reset input (R) and control input of the videosignal standart convertor 4 with RAM,

- second output (Uclb) is connected to second input of the first sheme 51 & (I) and to control input of the above indicated test-object location means 11 in the TV camera fields of vision (see fig.2), and

- third output is connected to D-trigger 52 reset input (R); output register 54 (RG O) for giving the information about syncronisator 7 condition in PC 6, in it:

- the first input is connected to above indicated synchroimpulse selector 37 output (VSI),

- the second input is connected to meter 50 output Udcc, and

- the output is connected to PC 6 data bus;

the decipherator 55 (DC A) of the address, programmely forming PC 6 port of the giving in synchronisator 7 the control commands in it:

- the input is connected to PC 6 address bus, and

- the output is connected to input C of the input register 53.

The multichannel digital corrector 13 of the videosignal amplitudes in whole is intended for coordination of the TV camera 1 videosignals by amplitude parameters (mainly in range and level of the "black") mainly with long fluoroscopic examinations or surgical operation motion controls. This corrector 13 is a set unbinded by channel inputs, the number of them equal the TV camera number and in each channel (see fig.6) has:

preferably two nonvolatile RAM 56 (NRAM1) and 57 (NRAM2), they accordingly are intending for saving of the corrected coefficient codes of the "black" level and maximum videosignal range for each pixel of the input image from corresponding (given channel) TV camera 1;

difference cascade 58 for calculation of difference input signal Ui(x,y) codes and "black" level Ub(x,y) for each input image pixel from corresponding TV camera 1;

divisor 59 for calculation of the amplitude correction standarting coefficients of the input videosignals by division the constant, setting (for choosing TV cameras 1 and ADC 2) code Umax of the maximum videosignal range on the alternative code Uw(x,y), corresponding the maximum videosignal range for each following pixel of the input image from corresponding TV camera 1;

decipherator 60 (DC) of the address programmely forming PC 6 port of giving control commands in given channel of the videosignal amplitude digital corrector 13 in it the input is connected to PC address bus 6;

input register 61 (RG) for reception control commands, entering from PC 6, in it:

- the first input is connected to PC 6 data bus and second input - to address decipherator 60 output, and

- outputs are connected to control inputs (r/w) of the nonvolatile RAM 56 and 57;

output multiplier 62 for forming of the standarted output videosignal Ucu(x,y) codes by multiplying of the mentioned standarted coeffocients on the mentioned difference signal code.

In such, as was spoke yet, most preferable execution form of the amplitude videosignal digital corrector 13 mentioned functional blocks side by side with indicated have follow external and mutual connections:

the RAM 56 (NRAM1) is connected:

- by information input - to output corresponding channel of the above indicated ADC block 2,

- by control input (r/w) - to first output of the input register 61 (RG),

the RAM 57 (NRAM1) is connected:

- by information input - to indicated difference cascade 58 output,

- by control input (r/w) - to second output of the input register 61 (RG), and

in address inputs the both RAM 56 and 57 (NRAM 1 and 2) are connected to above indicated synchronisator 7 X,Y output;

the difference cascade 58 is connected:

- by first input - to output corresponding channel of the above indicated ADC block 2,

- by second input (r/w) - to indicated block 56 (NRAM1) output,

- by output - on the first input of the indicated multiplier 62;

the division 59 is connected between RAM 57 (NRAM2) output and the second input of the multiplier 62.

The experts is undestood that in principle may manage by one nonvolatile RAM (NRAM) with insignificant quality losses of the amplitude correction.

Every interframe acumulator 14 (see fig.7) has:

two multiplier 63 and 64, they accordingly are intended for multiplying code Uin(x,y) of the each following input image pixel on the weight coefficient Ak and code Ui(x,y) of each accumulating

image pixel code on the weighting coefficient Bk, moreover the first input of the multiplier 63 is connected to output of the corresponding channel of the above indicated ADC block 2;

the summator 65 for calculating weighing sum of the each following pixel of the input image and corresponding acumulated image pixel codes in it the first and second inputs are connected accordingly to multiplier 63 and 64 outputs;

RAM block 66 (RAM) for saving of the acumulated image pixel codes Ui(x,y) in it:

- the first input is connected to the summator 65 output,

- the second input is connected to the synchronisated outputs of the above indicated synchronisator 7 with X,Y coordinate codes,

- the third input is connected to the control output Uc of the above indicated synchronisator 7, and

- the information output Ui(x,y) is a interframe acummulator output and connected:

-- to input corresponding channel of the above indicated videosignal amplitude digital corrector 13 (see fig.6), and

-- to first multiplier 64 input;

decipherator 67 (DC) of the address the programmely forming PC 6 port of giving in the interframe acumulator 14 of the weight coefficient Ak and Bk values, in it the input is connected to PC 6 address bus;

the output register 68 (RG) for reception weight coefficient Ak and Bk codes entering from PC 6, in it:

- the first input is connected to PC 6 data bus, and

- the second input - to address decipherator 67 output,

- the first output is connected to second multiplier 63 input, and

- the second output - to second multiplier 64 input.

The interframe accumulators may be without problem choosen by specialists from wide assortiment of commercially access products of such type.

The multichannel threshold control device 15 in whole is intended for operation:

directly - by primary X-ray source 12 by permiting absorbed dose and requaring quality of the synthesated integrate image criterions mainly in mass radiographic examinations and

though the above indicated synchronisator 7 - by interframe

accumulators 14.

It's the set unbinded by the channel inputs, the number of them equal the TV camera 1 number and in each channel (see fig.8) has:

the first comparator 69 for comparison image pixel codes forming by corresponding given channel TV camera 1, with threshold code U1;

the sheme & (I) 70, it by the first input is connected to comparator 69 output and intended for strobition of the clock signal f1 by output signal this comparator;

the meter 71, the accounting input (+1) of it is connected to sheme & (I) 70 output and it serve for calculation of the such pixel number in the image frame corresponding (connected to given channel) by TV camera 1, the the code of them exceed the U1 threshold;

the register 72 (RG), the information input (D) of it is connected to the meter 71 output and it serves for saving of the parallel output code this meter;

the second comparator 73, it though register 72 is connected to the meter 71 output and serves for comparison of the output code of this meter 71 with U11 threshold;

the trigger 74, it D-input is connected with comparator 73 output and it serves for writing of the logical output signal of this comparator by Uki synchronisated frame impulse end from above indicated synchronisator 7.

Besides, for all multichannel threshold control device 15 is entended following common functional blocks also showed in the fig.8:

the decipherator 75 (DC) of the programmely forming PC 6 port of the giving in the multichannel threshold control device 15 of the threshold codes U1, U11 and U12 in it the input is connected to PC 6 address bus;

the input register 76 (RG_D) for reception of the U1, U11 and U12 threshold codes, entering from PC 6, in it:

- the first inputis connected to PC 6 data bus, and
- the second input (C) - to address decipherator 75 output,
- the first output is connected to united first inputs of the above indicated comparators 69 of all channels, and
- the second output is connected to united first inputs of the

above indicated comparators 73 of all channels;

the multiplexor 77 (MX) for multiplexation of the output signals of all channels, in it:

- each information input is connected to trigger 74 outputs of the corresponding channels, and

- the control input is connected to the synchronisated output of the above indicated synchronisator 7 with X coordinate code;

the sheme & (I) 78 for strobition of the f1 clock signal by output signal of the multiplexor 77, in it:

- the first input is connected to multiplexor 77 output, and

- the second input is connected with united second inputs of the & (I) shemes 70 each channel of the multichannel threshold control device 15 and connected to output of synchronisated ("synchro-TV") signals the setting generator 40 (see fig.5), that is with the clock output of the above indicated synchronisator 7;

meter 79 for calculation of these channel number, the signals on trigger 74 outputs of them have the logical level "1", and it is connected:

- by accounting input (+1) - to & (I) shemes 78, and

- by reset (R) input - to Uki synchronisated output of the above indicated synchronisator 7 though the invertor 80;

the comparator 81, entended for comparison of the meter 79 output code with U12 threshold and connected:

- by first input - to meter 79 output,

- by second input - to third output of the above indicated input register 76 (RG_D), and

- by output - to none showed separately primary (X-ray) source 12 controller (see fig.2);

the trigger 82 for writing and saving of the comparator 81 output signal, connected

- by D-input - to this comparator 81 output,

- by clock input (C) though indicated invertor 80 - to Uki synchronisated output of the above indicated synchronisator 7 (see fig.5), and

by Usn output - to trigger 52 D-input of the above indicated synchronisator 7.

Besides, in each channel is united and in common connected to Uki synchronisated output of the above indicated synchronisator 7 the following inputs:

the reset input (R) of each meter 71,

the clock input (C) of each register 72 and

the clock input (C) of each register 74;

And, finally, the comparator 69 second inputs of all multichannel threshold control device 15 channels are connected to corresponding information Ucu1(x,y)...UcuN(x,y) outputs of the above indicated videosignal amplitude digital corrector 13.

The test-objects 10 with vertical (see fig.9) and horisontal (see fig.10) location of the spacing mirs by construction of the same type and contain the hard rectangular plate 83 from radiolucent material, for example, usual and irganic glass, and flooded in it or stretched over it the thin strings (threads) 84 from X-ray opaque material, for examlpe, steel. Instead of the plate may be used a hard frame.

The plate format (or frame) 83 corresponding by common field of vision format and their sizes exceed the common field of vision sizes of all TV cameras 1.

The strings 84 are wittingly located so that the field of vision of each TV camera 1 by installation was approximately limited and after installation - was clearly limited by two neighbouring strings accordingly by horisontal for first test-object 10 and by vertical for second test-object 10. By this the each inside (none extreme) string 84 at the same time limite the field of vision of the two neighbouring TV cameras 1 because of partial (+5%) exceeding of their fields of vision.

In particular, one of the test-objects has Nx+1 vertical and second test-object - Ny+1 horisontal (in working location) strings 84, where Nx and Ny - accordingly TV camera 1 number, located in horisontal and vertical in view of spacing grating. By this product Nx*Ny=N, that is the common TV camera 1 number.

On the figures 9 and 10, for example, are showed the shemes of the calibrated test-objects 10 for cases, when Nx=3 and Ny=3, and N=9.

Apart from the concrete embodiment invention plan the utilization of the suggesting high resolution TV system contain:

the preparation to work, finished, at least, by geometric distortion corrector 3 installation on the giving definited corrected coefficients, and

strictly speaking the exploitation, providing the forming form

fragment input TV camera 1 videosignals of the output videosignal corresponding by integrate image and, in case of need, the digital writing of the output videosignal for next analysis.

The preparation to work begin with mounting TV cameras on the arbitrary hard flucrum so that the fields of vision partialy was exceeded and their combined fields of vision exceeded by area of the image convertor 9.

In simpliest case, when the suggested TV system composition and structure correspond, in principal, by fig.1 and when in it don't include the blocks 10, 11, and 12, the geometric distortion corrector 3 must be beforehand by operator.

For this on the control unit, it may be by usual way assembled by experts, must be investigated all TV cameras 1 and quantitatively defined inherent to each of them the geometric distortions.

In virtue of given data by one of known algorithms (for example, the observated image from requared standart deviation minimisation algorithm) with taking into considaration of the information about mutual TV camera 1 location in the united block composition, the distance to observation object and, in case of need, such factors, as middle observation object brightness, must be accounted the corrected coefficients, providing the removal of the geometric distortions and the output videosignal correction.

Given corrected coefficients after that must be written in nonvolatile memory of the geometric distortion corrector 3, it allow pass from installation to exploitation of the suggested TV system exactly in those conditions for which were investigated theTV cameras 1 and accounted the corrected coefficients.

The geometric distortion correction essence and calculation maintenance become clearer from detailed automatic installation algorithm description in more complicated but preferable case, when suggested TV system correspond by fig.2 and is used, mainly, as X-ray TV system for control of the physiological (mainly quickly flowing) processes in real time.

In this case, the preparation to work consist in the automatic installation of the geometric distortion corrector 3 and, preferably, of the vidoesignal amplitude digital corrector 13.

The automatic corrector 3 installation begin with successive positining of the radiopaque vertical and horisontal calibrated

test-object 10 between image convertor 9 and primary X-ray source 12 by PC 6 command giving through the synchronisator 7 on the means 11.

Synchronely working TV cameras 1 read the forming by convertor 9 image by all their area with partial mutual exceeding of the fields of vision of the separate TV cameras 1.

The string 84 shades of the test-objects 10 (see fig.9 and 10) in each TV camera 1 field of vision has view of thin (usually two) lines: accordingly vertical - for each TV camera 1 of each horisontal line and horisontal - for each TV camera 1 of each vertical line. The distances between lines are defined by expressions:

$$L1 = L/Nx, \qquad (1)$$

where L - the common image field size by horisontal;

L1 - the distance between lines by horisontal;

Nx - the TV camera 1 number in line by horisontal, and

$$H1 = H/Hy, \qquad (2)$$

where H - the common image field size by vertical;

H1 - the distance between lines by vertical;

Ny - the TV camera 1 number in line by vertical.

The lines of each test-object 10 are separated image field on the rectangles, the each of them correspond by the field of vision of one of TV cameras 1. TV camera 1 optical systems in succession are installated and TV cameras 1 are fastened so, that in field of vision each of them by observation of the first test-object 10 the vertical lines would be located not far from left and right margins and horisontal lines located not far from top and bottom margins of the field of vision.

Each TV camera 1 videosignal in the corrector 3 enter on two corresponding to their comparators 18 (see fig.3), they compare the indicated videosignal code with Ut fixed threshold code and discovers accordingly the vertical and horisontal lines (raster margins) on the test-object 10 images. By this, the first decipherator 19 limite the initial and final line discovery zones on the test-object 10 images by X coordinate and second decipherator 19 - by Y coordinate.

When the comparator 18 discovers the line (string 84 shade) in setting zone, forming by synchronisator 7 Ustr control signal through corresponding sheme & (I) 20 enter on the control input

(r/w) of the nonvolatile RAM (NRAM) 21. By this, the first and second NRAM 21 accordingly fixed of the initial Lb(y) and final Le(y) abscisses of the raster margins by first test-object 10 and third and fourth NRAM 21 - initial Hb(x) and final He(x) ordinates of the raster margins by second test-object 10.

For this the synchronisator 7 give on the address inputs of the first and second NRAM 21 the Y coordinate code and on their information inputs - the X coordinate code and on the address inputs of the third and fourth NRAM 21 - the Y coordinate code.

After termination of the indicated Lb(y), Le(y), Hb(x) and He(x) values the means 11 take out last of calibrated test-object 10 from TV camera 1 fields of vision, the Ustr control signal, forming by synchronisator 7, transfers all NRAM 21 in reading regime, and corrector 3 automatic installation is finished.

The indicated Lb(y) and Le(y) values futher serve for correction of the output image fragment by way of pixel Xc coordinates by horisontal calculation and Hb(x) and He(x) - pixel Yc coordinates by vertical.

Such correction essence, necessary in any possible exploitation regimes of the suggested TV system, reduce, in the main, to execution of the following actions.

Xc and Yc coordinate code calculation of the corrected image is executed the difference cascades 22, the table standartisators 23, the multipliers 24 and summators 25 accordingly of the first and second of the above indicated calculators 16 by following algorithm:

$$Xc(y) = X(y)*(Le(y)-Lb(y))/Lo + Lb(y), \qquad (3)$$

$$Yc(x) = Y(x)*(He(x)-Hb(x))/Ho + Hb(x), \qquad (4)$$

where Lo and Ho - accordingly non-distorted horisontal and vertical image sizes of each Tv camera 1.

The Uic(x,y) corrected image pixel code reading from RAM 27 one of two control memory blocks 17 takes place in accordance with Xc and Yc accounting coordinates.

At same time with reading takes place the Ui(x,y) initial image pixel code writing in RAM 27 of the second control memory block 17 by X and Y addresses entering from synchronisator 7.

The RAM 27 writing and reading addresses of the first and second control memory block 17 forms the multiplexors 26.

The multiplexors 26 and RAM 27 of the first control memory

block 17 operation take place by Urw synchronisator signal and multiplexors 26 and RAM 27 of the second control memory block 17 - by Urw inverse signals with outputs of the invertors 28.

By this the first and second control memory blocks 17 work in antiphase: when the ones read the corrected image pixel codes by Xc and Yc addresses, the other write initial image pixel codes by X and Y addresses and vice versa. The alternation of the "writing-reading" cycles take place with TV camera 1 frame change frequency.

The output multiplexor 29 multiplese the signal with RAM 27 outputs of the first and second control memory block 17 in accordance with logical level (0 or 1) of the Urw from synchronisator 7.

As already was marked after installation of all geometric distortion corrector 3 channels worth while at once installate the videosignal amplitude digital corrector 13 (see fig.6).

In beginning of such installation the primary (X-ray) source 12 is included. ACD block 2 of each TV camera 1 forms (min)Ui(x,y) report codes corresponding by "black" level of the output videosignal.

In each channel of the indicated corrector 13 by control command from PC 6, entering through output register 61 (RG), for each fragment image pixel takes place the writing of the indicated codes in the nonvolatile RAM (NRAM) 56 in accordance with X and Y addresses, they are formed by synchronisator 7. Accordingly, in all channels of the corrector 13 are provided writing of such codes for all image field. After nonvolatile RAM (NRAM) 56 writing in all corrector 13 channels by PC 6 command turn into reading regime.

IN the future, the indicated codes will be immediately used as the Ub(x,y) corrected coefficients, defined the "black" level by correction of the integrate output videosignal fragments.

Analogously, after inclusion of the primary (X-ray) source 12 the ADC block 2 for each TV camera 1 from (max)Ui(x,y) report codes corresponding by maximum range of the output videosignal. Futher in each channel of the indicated corrector 13 by control commands from PC 6, entering through same input register 61 (RG), for each pixel of the fragment image takes place:

in the difference cascade 58 - subtraction

$$(max)Ui(x,y) - [(min)Ui(x,y)=Ub(x,y)],$$ and

in the nonvolatile RAM (NRAM) 57 - writing of the indicated

code difference in accordance with X and Y addresses, they are formed by synchronisator 7. Accordingly, in all corrector 13 channels are provided the writing of such codes for all image field.

Given differences in the future will be used in correction as Uw(x,y) corrected coefficients, defined the maximum range of the integrate output videosignal fragments.

After termination of this coefficient writing in RAN (NRAM) 57 of all channels these RAMs by PC 6 command turn into reading regime and the videosignal amplitude digital corrector 13 installation is finished.

The amplitude correction essence, it is necessary by itilization of the suggested TV system for X-ray diagnosis of different by X-ray passing human bodu part coefficient and, espacially, by automatic operation of the irradiation dose (and in other cases only desirable) consist in, in the main, following.

In each channel of the videosignal amplitude corrector 13 for each point with (X,Y) image coordinates forming by each TV cameras must be executed the actions, foreseen by expression:

$$Ucu(x,y) = (Ui(x,y)-Ub(x,y))*Umax/(Uw(x,y)-Ub(x,y)), \quad (5)$$

where Ucu(x,y) - the corrected videosignal on the corrector 13 output;

Ui(x,y) - the videosignal code on the corrector 13 input;

Umax - the maximum value of the videosignal range code for synteseted integrate image;

Ub(x,y) and Uw(x,y) - the corrected coefficient codes, the physical sense ans receiption ways of them is indicated above.

The subtraction from Ui(x,y) input videosignal code of the corresponding value of the "black" level code as corrected coefficient Ub(x,y), reading from nonvolatile RAM (NRAM) 56, takes place in the difference cascade 58. The execution of this operation with output videosignals of all TV cameras 1 allow set the united value of the "black" level for synteseted integrate image videosignal.

The integer-valued division result of the maximum value of the videosignal range code for synteseted integrate image on the maximum range of the fragment videosignal code (Uw(x,y) corrected coefficient, readind from nonvolatile RAM (NRAM) 57), with devisor 59 output enters on the multiplier 62. So, the devisor 59 and multiplier 62 lead to the fragment videosignal to united scale

corresponding by synteseted integrate videosignal.

In the exlpoitation regime the high resolution suggested TV system must function in the following way.

In the simpliest case, for example, by forming high resolution TV images of the earth surface on the mapgraphic image base on the photo film receiving by aero- or cosmic on the photo view, the initial image is projectioned immediately on the TV camera 1 optical systems.

The ADC block, in well-known way, transform TV camera 1 output videosignals corresponding the fragment images, in the digital form and give on the geometric distortion corrector 3 inputs.

This corrector 3, as was described above, remove such videosignal distortions of the fragment images, they prevent their "sewing" in the integrate image without visible fragment margins.

The high resolution integrate image synthesis takes place in the videosignal standart convertor 4 with RAM (see fig.4), in it on the information inputs (DI) of all nonvolatile RAM bank frame RAM 31 from corrector 3 enter corrected fragment videosignals.

The high resolution integrate image forming is begun with parallel writing of the indicated videosignals in the first frame RAM 31 by X and Y addresses, entering from above indicated synchronisator 7 through the first address multiplexors 30. For this the RAM bank operation decipherator 32 form the control signls and give them on the each first RAM 31 through corresponding them first multiplexors 30. By these signals on the (r/w) inputs the first RAM 31 turn into writing regime and signals on the (CS) inputs support the (DO) outputs of same RAM 31 in the high omm (Z) state. So, the each first frame RAM 31 write the first following frame of the corrected TV image corresponding TV camera 1.

The next following frame of such image in analogouos way will be written in second frame RAM 31 of all nonvolatile RAM banks with those differences that the X and Y address signals fron above indicated synchronisator 7 and other control signals from decipherator 32 will be given through second address multiplexors 30.

In same time period the first frame RAM 31 of all nonvolatile RAM banks will work in the successive reading regime of the fragment corrected videosignal lines of the previous frame in accordance with Xm and Ym addresses, entering from synchronisator 7 through the

first address multiplexors 30. By this the first frame RAM 31 outputs (DO) in succession is turned into active state by conrtol signals, they enter on the inputs (CS) with above indicated decipherator 32 through corresponding first multiplexors 30.

Successive reading takes place so:

At same time with writing beggining of the first frame line of the above indicated TV cameras 1 in the second frame RAMs 31 in the active state are turned the first frame RAM 31 outputs such RAM bank, ir corresponds by TV camera 1, located in the first column and first line, and read the first line of the written in it previous frame;

after that, the indicated first frame RAM 31 outputs are transfered in high omm state and in the active state are transfered first frame RAM 31 outputs of following RAM bank, it correspond by TV camera 1, located in the second column and first line, and is read the first line of the written in it previous frame;

the indicated operations are repeated to reading of the previous frame first lines from first frame RAM 31 of all RAM banks corresponding by TV cameras 1, they are located in the first line,

again are transfered in the active state the first frame RAM 31 of the RAM bank outputs (DO), it corresponds by TV camera 1, located in the first column and first line and read the second line of the previous frame;

during the parallel writing of the following frame first line in the second frame RAM 31 of all RAM banks from the first frame RAMs 31 such RAM banks which correspond by TV cameras 1, located in the first line, in succession read such Ny line number which equals by TV camera 1 line number;

with writing beggining of the following frame second line in the second frame RAMs 31 transference of the first frame RAM 31 outputs (DO) in the active state and reading of the previous frame lines take place analogously but beggining with (Ny+1) line;

after finishing of the reading from first frame RAM 31 of the RAM banks corresponding by TV cameras 1, located in the first line analogously are read the previous frame lines from RAM banks, they correspond the second line of the TV cameras 1 and so on.

Futher the parallel writing of the third and next and successive reading of the second and next following frames of the corrected TV images of the corresponding TV cameras 1 many times

is repeated with alternation of the taking part in it the first and second frame RAMs 31 of all nonvolatile RAM banks.

Futher the digital analog convertor 33 (DAC HRV) transfer the corresponding by integrate high resolution image digital code, entering with frame RAM outputs DO in the analog videosignal Uout.

At same time with writing in the frame RAM 31 the memory blocks (RAM1...RAMN) 34 buffer RAM by Uw signal of the one logical level, giving from PC 6 through synchronisator 7, parrallely are written the corrected fragment videosignals of the TV cameras 1 for their next entering in the PC 6. By this the memory block 34 outputs (DO) is in the high omm state in accodance with control signals with decipherator 35 (DC CS) outputs of the buffer RAM. By entering of the writing in the buffer RAM the high resolution image In PC 6, the blocks 34 by Uw command other logical level are transfered in reading regime and control signals with decipherator 35 outputs in turn are transfered these block 34 outputs in the active state.

The output videosignal of the videosignal standart convertor 4 with RAM through the block 5 enter in PC 6 for documentation, archivating or reflection on their own monitor (for control) and/or on the high resolution monitor 8 (for operative control or preliminary visual estimation).

For described utilization of the suggested TV system with control functions it's successfully managed PC 6 and synchronisator 7 in it (see fig.5):

a) the selector 37 picks out from full input TV signal Uin1 the initial synchroimpulses and forms on their base:

output line HSI and half-frame VSI synchroniseted impulses, using futher in the digital analog convertor 36 of the above indicated videosignal standart convertor 4 with RAM for forming of the full TV signal, entering on the entering in PC 6 block 5;

b) the selector 38 of the frame (synchro)impulses and trigger 39 form the control signal Urw for address multiplexors 30 of the above indicated videosignal standart convertor 4 with RAM for forming in this convertor (see fig.4):

adrresses of the writing and reading,

control signals by frame RAM 31 work regimes, including the commands on the chip chooses (CS) and on writing/reading (r/w), and

the control signals by input multiplexors 26 and reading/writing RAM 27 regimes of the control memory blocks 17 of

the above indicated geometric distortion corrector 3;

c) the synchro-TV generator 40 produces the clock signal f1, it enters:

in the above indicated ADC block 2 for setting of the "analog-code" transformation rate in the containing in this block the analog digital convertors and

on the accounting input of the meter 41 for forming of the X image pixel absciss codes in the TV cameras 1;

d) the meter 42 by line HSI synchronisated impulse signals of the synchroimpulse selector 37 forms the Y coordinate codes of the TV camera 1 image pixels;

(futher the indicated X and Y coordinate codes enters:

- on the information inputs of the address multiplexors 30 as writing addresses in the frame RAM 31 in the working regime,

- on the address inputs of the memory blocks 34 of the above indicated convertor 4 by entering the synthesated image videosignal in the above indicated PC 6 through entering block 5 and

- in the above indicated geometric distortion corrector 3, including:

-- in the calculators 16 on the decipherator 19 information inputs for forming of the control signals by nonvolatile RAM 21 (NRAM) reading/writing regimes and on the address inputs of this RAM 31 for reading of the written Lb(y), Le(y), Hb(x), He(x) values by installation necessary by calculation of the Xc and Yc corrected coordinate codes in the working regime, and

-- in the controlling memory blocks 17 on the multiplexor 26 inputs for forming of the writing addresses of the TV camera 1 videosignal codes in the working regime);

e) the meter 44 by synchro-HRV generator 43 signals forms the codes of the:

- Xm abscisses of the synthesated image pixels and

- Udc control signal, entering on the RAM bank operation decipherator 32 of the above indicated videosignal standart convertor 4 with RAM for selection of the RAM bank by reading of the written earlier TV camera 1 image pixel codes by forming of the high resolution integrate image in the working regime;

f) the HHSI comparator 45 and the HHSI one-vibrator 46 form the line (HHSI) synchroimpulses of the synthesated image videosignal;

g) the meter 47 by the line (HHSI) synchroimpulse signals with

the output of the above indicated one-vibrator 46 forms the Ym coordinate codes of the synthesated image pixels, they in common with the above indicated Xm absciss codes of the this image pixels enter on the address multiplexor 30 information inputs of the above indicated videosignal standart convertor 4 with RAM as reading addresses from frame RAM 31 in the working regime by formating of the synthesated integrate image on the above indicated monitor 8;

h) the HVSI comparator 48 and the HVSI one-vibrator 49 form the frame (HVSI) synchroimpulses of the synthesated image videosignal, they in common with the above indicated line (HHSI) synchroimpulses with output of the above indicated one-vibrator 46 enter on the digital analog convertor 33 of the above indicated videosignal standart convertor 4 with RAM for forming in the working regime of the Uout full TV videosignal of the synthesated integrate high resolution image;

i) the meter 50 by frame (HVSI) synchroimpulse signals forms the Udcc control signal, entering on the buffer RAM decipherator 35 for selection of the active, in given moment of time, memory block 34 by entering of the synthesated integrate image videosignal in the above indicated PC 6;

j) the input register 53 by the address decipherator 55 synchronisated signal of the programmely forming PC port 6 gives from this PC command and on their base forms:

the Uw control signal of the synthesated integrate high resolution image videosignal entering in PC 6 permission, entering in the above indicated videosignal standart convertor 4 with RAM,

the Uclb control signal of the installation regime inclusion, entering:

- on the above indicated means 11 for beginningof the positioning of the above indicated calibrated test-objects 10 in the TV camera 1 field of vision (by automatic installation of the TV system), and

- on the I sheme 51, it on this signal base forms Ustr control signal, entering in the geometric distortion corrector 3 for tranfrefing of the nonvolatile RAMs 21 (NRAM) in the writing regimes of the test-image margin coordinate codes (by automatic installation of the TV system);

k) the output register 54 gives in the above indicated PC 6 the frame (synchro)impulse signal, forming by frame impulse selector 38,

and Udcc control signal with the above indicated meter 50 output.

Other synchronisator 7 block functioning will be described below usely to other possible working regimes of the suggested TV system mainly for X-ray diagnosis needs, when for increasing of the integrate image quality worth while use the interframe accumulators 14 and multichannel threshold control device 15.

One of such regimes is caused, for example, the necessity in the automatic installation of the indicated system for fluoroscopic accompany of the surgical operations with using of probes. Really, by the X-ray TV system preparation to such operations often had to change the TV camera 1 interlocation with taking into consideration of the required operation field configuration and area.

In so far as the efficiency of such operations visibly depend from the probe location in the pacient body definition accuracy, the geometric correction quality of the integrate image taking out on the monitor 8 (that is the visible joint apsence between their fragments), acquire the special importance.

Accordingly, the geometric distortion corrector 3 work efficiency essentially depend from definition accuracy $Ub(x,y)$ and $Uw(x,y)$ corrected coefficients in the digital videosignal amplitude corrector 13.

However, it's known, that even by unworking X-ray source 12 the $Uin(x,y,t)$ videosignals after ADC block 2 are the sum:

$$Uin(x,y,t) = Ub(x,y)+Un(x,y,t), \qquad (6)$$

where

$Ub(x,y)$ - the constant part of the "black" levels (it for different image pixels from one of TV cameras 1 and even for different TV cameras 1 may be immaterially distinguished values), and

$Un(x,y,t)$ - the fluctuated part, is causing by noises of the indicated X-ray source 12, convertor 9 and Tv cameras 1.

By included indicated source 12 (in the installation or "idle motion" regimes of the TV system) the $Uin(x,y,t)$ signal will be defined by expression:

$$Uin(x,y,t) = Uw(x,y)+Ub(x,y)+Un(x,y,t), \qquad (7)$$

where

$Uw(x,y)$ - the practically constant for concrete TV camera value, corresponding by the maximum range and defined as $Kw(x,y)*Umax$ product, where

Umax - the signal, corresponding to the maximum image brightness, and Kw(x,y) - the attenuation coefficient (usually less a one), it's causing insignificant by value the flow irregularity from indicated source 12, the convertor 9 and Tv camera 1 optical system passing coefficient heterogeneousity and it's automaticaly defined and taken into considaration by submit of the suggested TV system;

Ub(x,y) and Un(x,y,t) - same that and in (6).

Well-known by experts mathematic modeling methods and/or experimentally it's undifficult beforehand define such Ak and Bk=1-Ak average coefficients accordingly for Uin(x,y) input and Ui(x,y) output signals of the interframe accumulators 14 by using of these the influation of indicated fluctuated parts on the Ui(x,y) signal quality on the input in the videosignal amplitude corrector 13 (and futher - in the geometric distortion corrector 3) will be essentially attenuated.

The codes of the indicated coefficients are fixed in the memory of the above indicated PC 6. By automatic installation or by the suggested TV system exploitation in most of working regies these Ak and Bk coefficient codes by control signal with address decipherator 67 output the programmely forming PC 6 port enter on the writing in the input registers 68 each interframe accumulator 14.

Then in the non-marked specially recircle countours of the interframe accumulators 14, each of these are executed on the two multipliers 63 and 64, summator 65 and RAM block 66 base (see fig.7), the Uin(x,y) input signals, entering with corresponding outputs of the above indicated ADC block 2 are multiplied on the Ak coefficient and summed up with multiplied on the Bk coefficient the Ui(x,y) input signals of the digital videosignal amplitude corrector 13, it promote by improvement of the synthesated high resolution image quality.

Really, each X-ray film, writing in PC 6 in view of high resolution digital videosignal must by the reproduction provide such image quality, which will be near to image quality on the wide format X-ray film.

By this it's desirable that it quality was reached for time, don't exceeding the exposure time, usual for radiographic procedures.

It's natural, that exposure minimization (and absorbed by patent ionizing radiation doze) don't always may be arrived by only one selection of the suitable by TV camera 1 sensuality therefore it's desirable immadiately after sufficient averaging of the videosignals in the interframe accumulators 14 "fruze" the satisfactory, fragments of the integrate output videosignal, write theirs and turn off the X-ray source 12.

For this beforehand (to the first radiography show) is put the three thresholds:

the minimum brightness threshold of the fragment videosignal, it is choosen as part (preferable non less a quarter but non more half) of the maximum TV camera1 videosignal ranage, using in the TV system structure, and it corresponds by U1 parallel code;

the U11 threshold as maximumly permissible in each fragment image the pixel number with the brightness less of the setting by code (it is usually chosen in the 20-35% limits from common pixel number in the indicated image), and

the U12 threshold, setting (usually in the 15-35% limits) such channels from their common number N in theirs the pixel number with brightness less the setting by U1 code less the threshold pixel number U11.

These thresholds futher are used in the following way.

When corrected in the digital corrector 13 by amplitude the fragment videosignals Ucu1(x,y)...UcuN(x,y) enter on the comparator 69 first imputs of the corresponding the multichnnel thershold control device 15 channels, on the second inputs of all these comparators 69 with above indicated PC6 through the input register 76 (R6-D) enter the parallel threshold code U1.

Futher in each channel:

the signal on the comparator 69 outputs and on the I sheme 70 output acquire the "1" logical level by execution of the condition:

$$Ucui(x,y) < U1 \qquad (8)$$

the meter 71 calculates the pixel number of the fragment image, for theirs is just the expression (8) and,accordingly, the brightness of theirs less the indicated threshold value,

the impulse sequence Uki with TV scan frame frequency, entering from the above indicated synchronisator 7, provides the reset of meter 71,

the impulses, calculated for "pass" of one frame time, by

frame end parallely is written in the register 72,

on the first and second inputs of the comparator 73 accordingly enter: from indicated register 72 - the signal from meter 71 and from input register 76 - the pc6 U11 threshold code.

The "1" logical signal on the comparator 73 output means that in the given channel the required exposure time is standed.

The logical signal with comparator 73 outputs of all channels through the triggers 74 by frame end of the fragment videosignal enter on the inputs of the common for all multiplexor 77 channels, on the control input of it enters X signal from the above indicated synchronisator 7.

The meter 79 with TV camera 1 change frame period calculators the channel number, in theirs the exposure are finished.

The comparator 81, on one of inputs of it through the input register 73 from PC6 enter the U12 threshold code, produce the "1" logical signal in such case, if in M channels from N the exposure is finished. The Usr output signal of the comparator 81 enters on the controler of the above indicated X-ray source 12 for it turns off.

By frame end of the comparator 81 output signal is copied in the trigger 82 and given in the above indicated synchronisator 7, it produces the control signal for tranferance of the interframe accumulators 14 in the memory regime and forming on their outputs the signal of the "freezing" fragment images, they enter in PC6 for writing and next reproduction and the integrate high resolution image analysis.

For synchronization of the suggested TV system block work in their full configuration the synchronisator 7 (see fig.5) side by side with the above indicated ones takes and gives the number of additional signals, synchronisated the terminationof the whole number whole frame member of the fragment videosignals accumulation in the interframe accumulators 14 with frame synchroimpulses, and just:

D-input of the D-trigger 52 takes the Usn control signal with the above indicated multichannel threshold control device 15 output,

on the clock C-input of same D-trigger 52 takes the sequence of the frame synchroimpulse with frame impulse selector 38 output in the synchronisator 7,

by the first front of each synchroimpulse of the indicated